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Glass Quality and Health in Public Housing

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Objective

The objective of this study is to investigate the health impact of two kinds of window glass on healthy individuals in a public housing in Denmark. Since the invention of the *insulating glass units* (IGUs) in the 1970s, a lot of innovative effort and talent has been put into optimizing the performance of window glass as climate screens. Unfortunately these efforts have served only one purpose; energy. A development which seems to continue in the build environment in the near future, and seems to be the most rational choice, if we do not consider other parameters, such as health. Spending on average 90 % of our time in the indoor environment, the quality of the window glass plays an important and yet overlooked role for our circadian rhythm, sleep, mood, wakefulness and levels of vitamin D. Recent discoveries about the missing piece in the lighting puzzle, the non-visual IpRGCs, put emphasis on natural daylight and its beneficial effects as an efficient *Zeitgeber*, however until now studies have focused on artificial lighting and not daylight

Method

This randomized controlled study will investigate the effect of the daylight quality, establishing two different indoor daylight conditions by using two different types of window glass in building blocks, housing a total N = 90 healthy individuals in 72 apartments. As part of a building renovation, all windows will be renewed. Tenants participating in the study will have their apartment randomized to either:

a) 2-layered clear low iron glass (g-value = 0,67, Lt = 0,83, U-value = 1,1) that allows ultraviolet and blue light to pass
b) 3-layered float glass (g-value = 0,35, Lt = 0,64, U-value = 0,7) that limits the blue and ultraviolet parts of the daylight

G-value = Solar heat transmission, Lt = Light transmittance, U-value = Heat transfer coefficient

Spectral transmittance (St) of both glass types will be measured in a controlled environment. Subsequently the study will collect information on wellbeing, mood, sleep, health, and self-reported days of illness. The circadian response spectrum as well as the ability to produce 25(OH)D, the Standard Erythemal Dose (SED), is measured and compared for each glass type across seasons. The study will sample data during four seasons (autumn, winter, spring and summer). Primary outcomes will be self-ratings of sleep, well-being and circadian rhythms, based on Pittsburgh Sleep Quality Index (PSQI), WHO-5 Wellbeing and SF-12. Secondary outcomes will be general satisfaction, self-reported days of sick leave and causes of illness. Exploratory outcomes will be ability to produce 25(OH)D measured in Standard Erythemal Dose for each glass type and their effect on the use of additional artificial lighting

Results

Expected results in September 2018

Conclusions

The hypothesis of the study is that different glass types by a differential transmittance of light, will affect human wellbeing, mood, sleep, illness, and the levels of D-vitamin differently. The exact effect of different window glass types will, for the first time ever, be examined in a real environment in healthy individuals. Based on the results, we hope to be able to introduce a new concept – called a *Healthiness Factor* of glass – in the build environment or at least to discuss it

Funding

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Fig. I. The Public Housing HAB, Haderslev, DENMARK, experimental block (top) and control block (bottom)

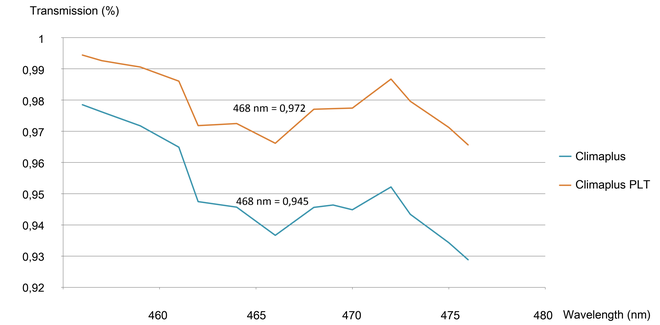

Fig. II. Two glasstypes and their different transmittance of the full spectrum light is tested in this study

1 = 2-layered low-iron glass

2 = 3-layered float glass

NB. The figure shows spectral transmittance in the sensitive area of IpRGCs 460 – 480 nm